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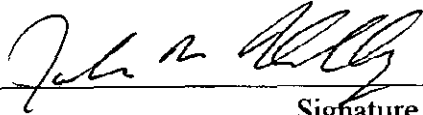
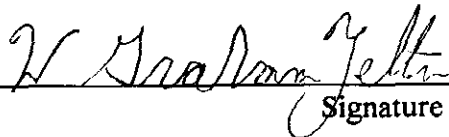

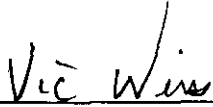

SANDIA NATIONAL LABORATORIES
CHEMICAL & DISPOSAL ROOM PROCESSES DEPARTMENT 6748
WASTE ISOLATION PILOT PLANT PROJECT

TOP-549

CALIBRATION, USE, AND MAINTENANCE OF
THE PMS-100 MICRO LASER PARTICLE SPECTROMETER

Revision 0

Effective Date: 1/15/96

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1.0 REVISION HISTORY

None. This is an entirely new document.

2.0 PURPOSE

This procedure provides for the calibration, operation, maintenance of the PMS-100 Micro Laser Particle Spectrometer as part of the laboratory geochemistry research activities in support of the Waste Isolation Pilot Plant (WIPP) Project.

3.0 SCOPE

This procedure is applicable only for the PMS-100.

This document is not meant to substitute for the manufacturer's instruction manual for the PMS-100. The user is responsible for reading and understanding the manual (see references).

4.0 SAFETY

This document does not address ES&H issues. Laboratory ES&H procedures described in the SOPs of the laboratory in which the equipment is used shall be adhered to.

5.0 RESPONSIBILITIES

The Principal Investigator (PI), or designee, whose activities warrant the use of this procedure is responsible for implementing the requirements of this procedure.

The Project Scientist (PS), or designee, is responsible for performing the calibrations and measurements following the requirements of this procedure, documenting calibrations, and assuring that the latest revision of this document is followed.

The Quality Assurance Manager (QA Manager) is responsible for monitoring the work to assure proper implementation of the procedure and for assuring its continued effectiveness.

6.0 CONTROLS

Controls are established by written procedures or instructions prepared in accordance with QAP 5.3, PREPARING, REVIEWING, AND APPROVING TECHNICAL OPERATING PROCEDURES (Revision 1, effective date: 7/31/95) of the Sandia National Laboratories WIPP Quality Assurance Program. Procedures are issued in accordance with QAP 6.1, DOCUMENT CONTROL SYSTEM (Revision 1, effective date: 7/31/95) of the Sandia National Laboratories WIPP Quality Assurance Program.

6.1 STANDARDS

Calibration will be verified using commercially obtained particle size standards that are traceable to NIST or other nationally recognized standards. The lot numbers and expiration dates (if any) of the standards used shall be recorded in the laboratory notebook.

The standards will not be used past the expiration date listed on the container by the manufacturer.

6.2 FREQUENCY

The instrument will be recalibrated upon failure of a performance test.

The instrument's calibration shall be verified with performance tests immediately prior to use.

6.3 PERFORMANCE TEST CRITERIA

Performance tests will be done by measuring the size and concentration of an appropriate particle size standard.

If the highest number of counts are not seen in the appropriate size class, routine maintenance shall be performed, and the performance test repeated. If the instrument again fails the performance test, it shall be returned to PMS for recalibration.

If the difference between the measured concentration and the known concentration of the standard is greater than 10%, it shall be recalibrated by the user.

To ensure that the instrument's linear range is not exceeded, concentrations used for performance tests shall exceed the highest concentration to be analyzed. If a sample is analyzed and is found to be outside the instrument's demonstrated linear range, the operator may either : 1) Extend the demonstrated linear range by successfully quantifying a standard of higher concentration than the sample in question or 2) Dilute the sample down to within the demonstrated linear range and reanalyze. (The instrument's linear range extends to about 1×10^8 particles/mL at a sampling rate of 0.5 mL/minute).

7.0 CALIBRATION

The instrument shall be recalibrated if it fails a performance test.

If the performance test for particle sizing is failed, the instrument shall be returned to the manufacturer for recalibration.

If the performance test for particle concentration is failed, the instrument shall be recalibrated by altering the "% sampled" figure under "setup".

7.1 CORRECTIVE ACTION

A performance test will be done immediately after calibration. If the instrument still fails its performance test, it shall be tagged and placed out of service and the manufacturer (Particle Measuring Systems, Inc., Boulder, CO) shall be contacted to initiate repair.

Failures of performance tests and the remedial action taken shall be documented on the analysis printout. Failures of more than one performance test in a given day shall be documented in the appropriate scientific notebook.

8.0 PROCEDURE: PARTICLE SIZE MEASUREMENT

Analyses will be performed as per instructions in the operator's manual (see Appendix 1).

8.1 OPTIMIZATION

Bacterial growth is the primary interferent. To minimize bacteria in the system.:

1. Add about 1mL of bleach to the tank if background levels are high.
2. When shutting the system down, drain the tank, minimize fluid in the sampler, and add 0.1 mL of bleach to the filter housing water (the filter must be stored wet).

Never store the sensor cell dry.

Keep the pump running whenever the tank is not empty.

Avoid introducing bubbles into the sample system, as they will add to the noise levels.

Use the tank water as diluent for samples (but NOT while sampling!). DI water is relatively dirty.

Thoroughly clean all containers, and filter all liquids to be used prior to starting any experiment.

Replace tank water weekly when in use.

Keep flow rate for system as close as possible to 100 LPM (quantification is affected).

9.0 MAINTENANCE

Maintenance and troubleshooting will be performed on the instrument as instructed in the operator's manual (see Appendix 2).

10.0 QA RECORDS

Performance test and data printouts will be submitted to the SWCF or the results will be recorded in the laboratory notebook in accordance with Sandia National Laboratories WIPP Quality Assurance Procedure 20-2, "PREPARING, REVIEWING, AND APPROVING SCIENTIFIC NOTEBOOKS" (Revision 1, effective date: 7/31/95).

11.0 REFERENCES

Particle Measuring Systems, Inc., 1990, *Micro Laser Particle Spectrometer User's Guide to Operations*, Particle Measuring Systems, Inc., Boulder, CO

QAP 5.3, PREPARING, REVIEWING, AND APPROVING TECHNICAL OPERATING PROCEDURES (Revision 1, effective date: 7/31/95)

QAP 6.1, DOCUMENT CONTROL SYSTEM (Revision 1, effective date: 7/31/95)

QAP 20.2, PREPARING, REVIEWING, AND APPROVING SCIENTIFIC NOTEBOOKS (Revision 1, effective date 7/31/95)

APPENDIXES

Operator's Manual - Particle Measuring Systems' PMS-100

APPENDIX 1: Analysis 40 pages

APPENDIX 2: Maintenance 4 pages



Introduction to the Data System

The Micro LPS data system accepts particle data, analyzes the data, displays the data, and prints reports. The data system also allows you to configure the Micro LPS to monitor and report data in the format most suitable to your purpose.

To acquaint you with the data system, this chapter describes:

- how to use the front panel keys
- four kinds of displays (data, setup, help, and warnings and alarms)
- the information contained in the headers of the screens
- how to change the date and time

Front Panel Control Keys

The front panel contains the keys used to customize the system, sample and produce reports. Front panel controls include:

- the directional keys
- the printer linefeed key
- the alphanumeric keypad
- the Enter key
- the Help key
- four "soft" keys
- the Setup key
- the Print key

>>

Locate these keys using Figure 5-1.

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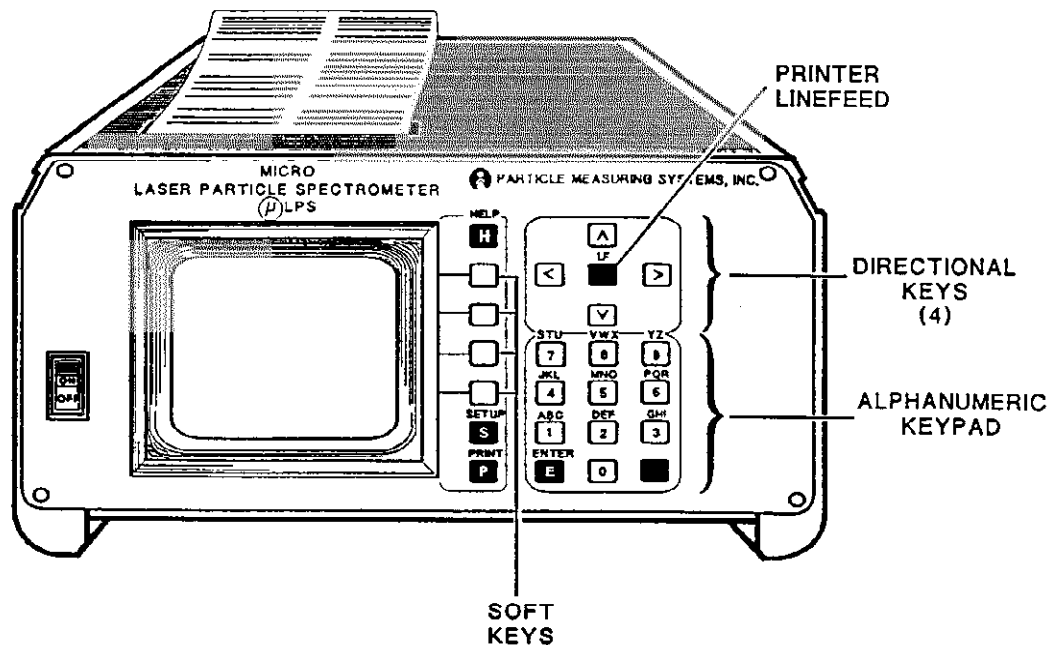


Figure 5-1. Front Panel Keys

Each of the keys performs one given function except for the four soft keys. The four soft keys' functions vary depending upon the display currently being viewed, whether sampling is in progress or stopped, and the system's configuration. Because their functions vary, these keys' labels appear on the display and directly to the left of each key inside the boxed column (Figure 5-2).

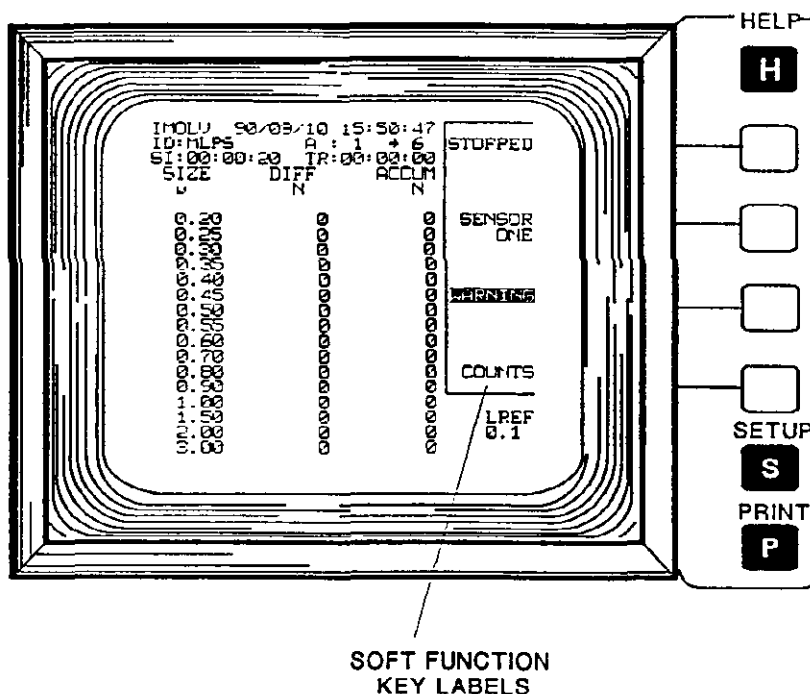


Figure 5-2. Soft Key Labels

The labels change when the keys are pressed to toggle to another mode or selection. For example, when you are viewing a data display, the top-most soft key is labeled STOPPED, DELAYED, RUNNING or FINAL, depending upon whether sampling has been manually stopped, the instrument is waiting out an interval between samples, the instrument is sampling, or sampling has been completed. If the label shows STOPPED, you can press the key to begin sampling. The label changes to RUNNING and the Micro LPS begins accepting data. You can press the key again to stop sampling.

Table 5-1 summarizes the use of the front panel keys. This table is useful for reference; however, for a full explanation of the soft keys, refer to Chapters 6 and 7.



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Table 5-1.
Front Panel Keys

HELP	Enters and exits the Help screen from a data display.
RUNNING/DELAYED/ STOPPED/FINAL	Starts and stops sampling, reports current sampling status.
SENSOR ONE/SENSOR TWO	Toggles between two sensors and identifies the sensor currently being sampled or configured. Enables access to the sensor one and sensor two setup displays.
WARNING/ALARM	Flags the operator to indicate that a warning condition exists or an alarm threshold has been exceeded.
COUNTS/N/ml	Toggles between displays of actual counts and concentration data (histograms always display data in percent of total counts).
SELECT NEXT OPTION	Cycles through available options in the setup screens.
PREV SCREEN	Cycles backward through the setup screens.
NEXT SCREEN	Cycles forward through the setup screens.
SETUP	Toggles between the data display and setup screens.
PRINT	Prints the currently displayed screen on the Micro LPS printer.
HOME/LINE FEED	Advances the printer paper about one-half inch.

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The exact form of the display you are viewing may vary from the example shown here depending upon whether your instrument has 8 or 16 channels and whether the software has been configured for an IMOLV, LVMS, HSLIS, etc.

There are three types of data displays:

- tabular
- histogram
- analog

The display you are now viewing is a tabular data display. During sampling, this display monitors particle counts. The histogram also monitors particle counts, but in a graphic format. The analog display monitors analog inputs from peripheral devices such as temperature and humidity probes.

NOTE

The histogram data displays are a standard feature of the Micro LPS-16 and optional with the Micro LPS-8.

>>

Access these displays from the tabular display by pressing either the up- or down-arrow key.

When data is being taken, the data screens display real-time data. In other words, data appears on the screen at essentially the same time the particle is detected or the analog input is received. Sampling operations can be started and stopped from any data display. The data displays are described in detail in Chapter 7.

Help Displays**>>**

Help screens are available from the data displays by pressing the HELP key. Press the HELP key to access this display:

uLPS - 16

Version: 11.65
Gen: Aug 29 1990 10:45:08
Sensor 1: IMOLV- .2
Sensor 2: IMOLV- .2

PMS Service:
FA (215) 630-0914
TX (214) 578-9190
CO (303) 443-7100
CA (415) 490-9301

Press HELP to exit
Press UP/DOWN for other pages

>>

Use the up- or down-arrow key to access the other help screens.

Press the HELP key to exit the help screen.

Setup Displays

>>

The setup displays contain options that enable you to customize sampling.

To view a setup display, press the SETUP key. The Micro LPS displays a screen similar to the following:



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```

SET1-1 90/09/10 16:01:36
ID:MLPS A: 1 → 6
SI:00:00:20 TR:00:00:00
Sample ID: MLPS
Sample Mode: TIME
Sample Int: 00:00:20
Flow Rate: 0.00

Group A: 1 thru 6
Group B: 7 thru 12
Sample Print: NO
Delay Time: 00:00:20
Collect Group B: NO
Group Print: NO
Repeat Mode: SINGLE
Collection: INDEPENDENT
Printer type: B
Hmode: SPECTROMETER

```

SELECT
NEXT
OPTION

PREV
SCREEN

NEXT
SCREEN

Notice that in the upper left corner this screen is identified as the SET1-1 (or SET1-2) screen, identifying it as page one of the setup screen for sensor one (or sensor two). There are three setup screens for each sensor.

»

To view the other two setup screens press either the NEXT SCREEN or PREV SCREEN key.

Pressing either of these keys repeatedly continuously cycles forward or back through the three screens.

Detailed information on the options contained in each of these screens and how to configure for sampling is located in Chapter 6.

Warnings and Alarms

The fourth type of display contains operator messages regarding warning and alarm conditions. An alarm alerts the operator to the fact that a user-defined threshold has been exceeded.

When the Micro LPS displays a warning or alarm flag, press the Warning key to display the message, for example:

Warnings--

*Low laser reference on probe 1

Press ENTER to exit

Press Enter to exit the warning or alarm message display. For specific warning messages, refer to Chapter 8.

The Header

Regardless of the type of screen you are viewing, header information appears in the top three lines of each display:

```
IMOLV 90/09/10 15:59:32
ID:MLPS A: 1 7 6 STOPPED
SI:00:00:20 TR:00:00:00
```

The first line contains:

- the display type
- the date
- the time

The second line contains:

- the instrument identifier
- the group and sample number

The third line contains:

- the sample interval
- the time remaining in the sample interval or delay time



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Display Type

The display type is identified in the upper left corner. On power-up a data display is always shown. When a data display is shown, the first field in the upper left corner may identify the display type as either:

IMOLV
HVLIS
HSLIS
LVMS
GVMS
LPOU
CLPOU

The data screen display type indicates what type of sensor is employed in the system.

If the display is a setup screen, the display type shows:

SET Screen # - Sensor #

where Screen # is 1, 2 or 3 and indicates whether you are viewing the first, second or third setup page; and Sensor # is 1 or 2 and indicates to which sensor the currently displayed information applies. For example, if the upper left corner of the display shows SET2-1, you are viewing the second setup page for sensor 1.

To access the setup page for sensor 2:

1. Press the SETUP key to return to the data display.
2. Press the SENSOR TWO key.
3. Press the SETUP key to return to the sensor 2 setup page.

The Date

The date is contained in the second field of the first line and is shown in the format:

YY/MM/DD

The Time

The time is contained in the third field of the first line and is shown in the format:

HH:MM:SS

Sample ID

The first field of the second line, the sample ID, is user-specified through a setup display and is reflected on reports.

Group and Sample Number	<p>During sampling, the second field of the second line contains the group identifier (either A or B) and the sample number. For example, while the first sample of group A is being taken the following appears:</p> <p style="text-align: center;">A : 1</p> <p>When a group sampling is complete and the data is shown on the display, this field shows the group and total number of samples taken as follows:</p> <p style="text-align: center;">A : 1 → 2</p>
Sample Interval	<p>The sample interval is user-specified through the setup display. It is shown in the format:</p> <p style="text-align: center;">HH:MM:SS</p>
Time Remaining	<p>The time remaining (TR:) reflects how much time is left in the current sample interval or delay interval between either individual samples or group samplings. If a sample is manually stopped, this field displays the remaining sample time. If your System includes a sampler, SAMPLER WAIT appears in this field between samples.</p>

Changing the Date and Time

The date and time are changed from the first page of the setup screen.

1. Locate the display labeled either SET1-1 or SET1-2.

Notice that the cursor (blinking light) appears in the header in the date field. The date and time are displayed in the format:

YY/MM/DD HH:MM:SS

2. To change the date, use the right-arrow directional key to place the cursor in the field you want to change and the alphanumeric keypad to enter the correct number. When a field is shown correctly, move on to the next field using the directional keys. If you make an error and need to go back to a field, use the left-arrow key.
3. Use the same method to change the time. Enter the time using the 24-hour format where 00:00:00 is midnight and 23:30:20 is 30 minutes and 20 seconds after 11 P.M.



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The other configurable header items (ID and SI) are entered through the options on page one of the setup display you are now viewing and are described in the next chapter.



Setup Screens

The Micro LPS is user-configured for sampling and reporting through three setup screens. The Micro LPS can be configured to:

- run individual samples or groups of samples of any duration, either once or repeatedly
- print reports of actual counts or normalized data which include all data taken or exclude questionable samples
- accept, monitor and report data from analog devices
- display and/or print alarm condition information
- sample with two sensors working either independently or simultaneously

All configuration is done through the setup screens. There are three setup screens (or pages) for each sensor connected to the system. The content of the setup screens varies depending upon what type(s) of sensor is used. The data system program in your instrument has been factory-configured to your system's hardware configuration; therefore, when this manual shows an example of a setup screen, the format and content may vary slightly from the equivalent screen on your system. Most of the examples in this manual are taken from a system with IMOLV sensors. The data screen examples show IMOLV in the upper left corner, while your screen may show LPOU or HSLIS, for example. Some of the available options may vary as well. All options for all sensors are described in this chapter; your program will not contain all options - only those specific to your sensor type(s).

The Micro LPS can serve as a data system for the following types of samplers:

SOPS-100
LBS-100
CLS-100
CLS-200
CLS-300
CLS-500
CLS-600

The data system program installed in your instrument contains options for each of these samplers; however, you will most likely initially select and thereafter always use the same one.

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This chapter allows you to customize sample-taking, set alarms and generate reports by describing:

- the functions of the soft keys found on the setup screens
- each of the options on each of the three setup screens

The options are presented in the order in which they appear on the displays.

Setup Screen Soft Keys

As described in Chapter 4, each soft key is labeled on the display and directly to the left of the key. The setup screens have three soft keys: SELECT NEXT OPTION, PREV SCREEN, and NEXT SCREEN.

SELECT NEXT OPTION

This key is used to cycle through available options. For example, Sample Mode may be either FLOWMETER, SAMPLER or TIME. To cycle through the options, place the cursor on the Sample Mode line and press the SELECT NEXT OPTION key repeatedly. Whatever is currently displayed when you leave the setup screen is the current selection.

PREV SCREEN

There are three setup screens. To cycle backward through them press PREV SCREEN.

NEXT SCREEN

To cycle forward through the three setup screens press NEXT SCREEN.

SET1-1/SET1-2 Options

Use the PREV SCREEN or NEXT SCREEN key to locate setup page 1 (SET1-1 or SET 1-2) to access the following options. Setup page 1 options are described in the following pages.


```

SET1-1 90/09/10 16:01:36
ID:MLPS A: 1 → 6
SI:00:00:20 TR:00:00:00

```

```

Sample ID: MLPS
Sample Mode: TIME
Sample Int: 00:00:20
Flow Rate: 0.00

```

```

Group A: 1 thru 6
Group B: 7 thru 12
Sample Print: NO
Delay Time: 00:00:20
Collect Group B: NO
Group Print: NO
Repeat Mode: SINGLE
Collection: INDEPENDENT
Printer type: B
HLmode: SPECTROMETER

```

```

SELECT
NEXT
OPTION

```

```

PREV
SCREEN

```

```

NEXT
SCREEN

```

Sample ID

The sample ID is reflected on printed reports. It may be up to 10 characters long and be any combination of letters, numbers, periods, and spaces. Use the alphanumeric keypad to enter an ID.

How to Use the Alphanumeric Keypad

Notice that each of the keys on the keypad is assigned a number, and two or three letters of the alphabet above the key. With the cursor in the Sample ID field (or any field that accepts alphanumeric entries), pressing a number key once causes that number to be displayed; pressing the same key twice causes the first letter above that particular key to be displayed. Pressing the same key repeatedly causes the display to cycle through the letters and back to the number associated with that particular key to be displayed. For example:

```

if you press 7 once, "7" is displayed
if you press 7 twice, "S" is displayed
if you press 7 three times, "T" is displayed
if you press 7 four times, "U" is displayed
if you press 7 five times, "7" is displayed

```

When entering the ID, after each number or letter has been correctly entered, press the ENTER key. The cursor automatically moves to the next available position. Use the direction keys to exit the field after the correct ID is entered.



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NOTE

To edit an ID you must re-enter it.

To create a space, use the "YZ " key.

Sample Mode

This option enables the Micro LPS to determine how the sample interval will be set. Place the cursor on this field and select either FLOWMETER, SAMPLER, or TIME using the SELECT NEXT OPTION key. The options available in the next three lines of the display vary depending upon which mode is selected. These options are described in the following paragraphs.

Flowmeter Mode

Select FLOWMETER when the Micro LPS is part of a system that contains a digital flowmeter. When a flowmeter is installed in the system, the sample interval is determined by the volume sampled. The system may include an LPOU, IMOLV, LVMS, HSLIS, HVLIS or a CLPOU. Notice that when you select FLOWMETER, the two fields below your selection are Sample Volume and Pulses per ml.

Sample Volume

If you have selected FLOWMETER, this option appears. Enter the number of milliliters to be sampled. Use the following formula to determine the sample volume:

$$\text{Sample Volume} = \text{TFR} \times \% \text{ Sampled} \times \text{Time}$$

where:

TFR is the total flow rate of the entire volume in milliliters per minute.

% Sampled is the percent of the entire volume from which the sensor accepts counts (refer to % Sampled on setup page 2).

Time is the duration of the sample interval in minutes.

Pulses per ml	<p>If you have selected FLOWMETER, this option appears. Enter the number of pulses per milliliter that will be received by the Micro LPS from the flowmeter. This information is available in the flowmeter documentation. This allows the Micro LPS to stop data-taking operations when the appropriate sample volume has been reached.</p>
SAMPLER Mode	<p>Select SAMPLER when the Micro LPS will be collecting data from either a CLS-200, -300, -500, -600, SOPS-100, or an LBS-100. When one of these samplers is installed in the system, the sampler controls the sample interval. If you select SAMPLER, the next option that appears on the display is Sample Volume.</p>
Sample Volume	<p>If you have selected SAMPLER this option appears. Enter a sample volume number in milliliters that your sampler is capable of drawing.</p> <p>If you elect to report normalized counts (N/ml) rather than actual counts, the Micro LPS uses the sample volume to compute particle concentrations (refer to Data Display Soft Keys in Chapter 7 for more information). As the aliquot is drawn, the N/SEC is reported because the currently drawn volume is unknown. N/ml is computed and displayed at the end of the sample.</p> <p>Generally, sensors which sample 100% of the sample volume are used with samplers. If another type of sensor is used, the Micro LPS uses the adjusted volume (% Sampled entered on SET2-1) to compute the concentration.</p>
TIME Mode	<p>Select TIME when neither a sampler nor flowmeter is in the system configuration. The Micro LPS controls the sample-taking based on a designated sample time. Notice that when you select TIME, the following two fields that appear are Sample Interval and Flow Rate.</p>
Sample Int(erval)	<p>If you have selected TIME, this option appears. Enter a sample interval in the form:</p> <p>HH:MM:SS</p>



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Flow Rate	<p>If you have selected TIME, this option appears. Enter the flow rate through the sensor in milliliters per minute. If you enter 0, the Micro LPS computes N/SEC when normalized counts (N/ml) is selected on the data display.</p>
Group A/ Group B	<p>Individual sample data may be collected and grouped together for analysis using these fields. Up to twelve samples can be analyzed as one group (group A), or up to twelve samples can be analyzed in two groups (groups A and B). When samples are grouped for analysis, the samples in each group must be taken sequentially. For example, samples 1 through 4 can constitute group A, and samples 5 through 12 can constitute group B; or 1 through 3 constitute group A, and 4 through 6 constitute group B.</p> <p>To specify the size of the group, move the cursor to the Group A field and enter the second number using the alphanumeric keypad.</p> <p>Notice that the number entered here affects the first number shown in the Group B field. If the maximum number of 12 is selected, the Group B line disappears. If samples from only one group are to be collected, set the "Collect Group B" field to NO.</p> <p>If single samples are to be taken (either once or repeatedly) enter:</p> <p style="padding-left: 40px;">Group A:1 thru 1 Collect Group B: NO</p> <p>If you are taking single samples or not collecting Group B samples, the setting for Group B is inconsequential.</p>
Sample Print	<p>Use this option to indicate whether you want a printout automatically generated whenever the sample interval is completed or the sample volume has been met. Use the SELECT NEXT OPTION key to display either YES or NO.</p>
Delay Time	<p>This option is pertinent only if you are going to collect data from multiple samples. The delay time is the time between the end of one sample and the beginning of the next. It is specified in the form:</p> <p style="padding-left: 40px;">HH:MM:SS</p> <p>This interval can be used to set sampling at regular intervals. If the delay time is set to zero and continuous or multiple samples are being taken, upon completion of a sample, the Micro LPS immediately proceeds with the next sample.</p> <p>If your system includes a sampler and an insufficient delay time is designated, the sampler ignores the specified delay time.</p>

	<p>To enter the delay time use the alphanumeric keypad and the right- and left-arrow keys to reposition the cursor, if necessary.</p>
Collect Group B	<p>Use this option to specify whether data is to be collected for a second sample group which has been defined by the "Group B" option. Select YES or NO using the SELECT NEXT OPTION key.</p>
Group Print	<p>Select YES or NO using the SELECT NEXT OPTION key. If YES is selected, the average of Group A is calculated and printed; and, if Collect Group B is YES, the average of Group B is also calculated and printed. If Group Print NO is selected, neither is printed.</p>
Repeat Mode	<p>Use the SELECT NEXT OPTION key to toggle between CONTINUOUS and SINGLE. If you select SINGLE, group A samples are run once and, if Collect Group B: YES has been selected, group B samples are run once.</p> <p>If you select CONTINUOUS, the Micro LPS completes one group of samples (either group A only or groups A and B), and after the specified delay time, begins another group sampling. The instrument continues to sample in this manner until you manually end sampling by pressing the RUNNING/STOPPED key.</p>
NOTE	<p>If you are using a sampler, press the RUNNING/STOPPED key after the buret has drained to avoid retaining fluid in the buret.</p>
NOTE	<p>If you stop sampling in mid-group, previous sample data is lost.</p>
Collection	<p>The two available selections for this option are INDEPENDENT and SLAVE. If you have a one-sensor system, select INDEPENDENT. If you have two sensors, use this option to define whether the Micro LPS will collect data from each of them independently or from both sensors simultaneously.</p> <p>If you select INDEPENDENT for a two-sensor system, the setup displays SET1-1 and SET1-2 can be displayed and unique values entered for each sensor for the various setup fields. When you begin sampling in this mode, data is taken from each sensor as if it were the only sensor in the system.</p>



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SLAVE can only be selected for one sensor of a two-sensor system. The slave sensor begins and ends sampling at the same time as the independent sensor. When you select SLAVE, the following fields immediately adopt the selections made for the independent sensor:

- Sample Volume
- Sample Time
- Delay Time
- Pulses per ml
- Repeat Mode
- Group A
- Group B
- Collect Group B

These fields are not selectable on the slave's setup pages. Other parameters, however, are not affected and must be set separately. For example, Group Print settings may be specified separately to print results from one sensor and not the other.

Printer Type

PMS installs one of two types of printers in the Micro LPS. This option is factory-set for the printer in your instrument. If, however, your printouts appear as mirror images, select the other option using the SELECT NEXT OPTION key.

H_mode

This field is selectable only if you are operating with an HSLIS or HVLIS. With any other sensor, this field always reads SPECTROMETER. If you are using an HSLIS or HVLIS you can use the SELECT NEXT OPTION key to display MONITOR or SPECTROMETER.

In spectrometer mode, the sensor samples particles from a smaller region which is defined by the highest intensity of the laser beam. This percentage of the laser beam represents the relatively flat top portion of the Gaussian curve where particles are illuminated most uniformly. The reflected light from this region can be translated into highly reliably sized particles.

In monitor mode, the sensor counts particles which pass through a larger region of the beam. Since the intensity is less in this additional region, large particles are sized as small particles in this area. Sample volume is increased; however, sizing resolution is degraded.

The normal operating mode for the PMS instruments is SPECTROMETER. PMS offers the MONITOR mode as a means to compare our data to data derived from other manufacturers' sensors and for diagnostic purposes.

The extent of the sampled region is defined by the % Sampled field (on setup page SET2-1 or SET2-2). This figure should be nominally set according to the recommendations for the type of sensor you are using (refer to your sensor manual). When you change from one mode to the other, the Micro LPS automatically adjusts the % Sampled field. For example, the HSLIS in spectrometer mode samples approximately 0.33% of the total volume; in monitor mode that figure is approximately 1%. When you change modes from spectrometer to monitor or vice versa, the Micro LPS automatically adjusts the % Sampled field by a factor of about 3. The HVLIS adjustment factor is approximately 2.

When the Micro LPS is in Monitor mode, an M is displayed in the lower right corner; when in Spectrometer mode, an S is displayed.

NOTE

It is important to note whether you are in monitor or spectrometer mode when entering the % Sampled value.

SET2-1 and SET2-2 Options

Use the NEXT SCREEN key to display the second setup page. The options located on this display are described in the following pages.

```

SET2-1 90/09/10 16:45:57
ID:MLPS      NO DATA
SI:00:00:20  TR:00:00:00

Post pro comp: A
Sample: INCLUDED

% Sampled: 100.0000
Vertical Scale: 50.00
View Module: A
Max View Module: A
Min Flw(ml/min):0.00
Units: milliliters
First Sample: accept
Sampler Type: CLS-200
Fill Speed: 0
Drain Speed: 0
Count during: fill
Control from: WLPS-16
  
```

SELECT
NEXT
OPTION

PREV
SCREEN

NEXT
SCREEN



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Post Pro Comp
(Post-Processing
Computations)

Use this field to indicate what data is to be displayed and/or what computations are to be performed on the data. You can select either:

A
B
A-B
B-A
2/1
(1-2)/1
SAMPLE 1, SAMPLE 2,...SAMPLE 12

If you select either A or B, group A or B data are displayed. The next two options display the difference between the two groups of data.

Options 2/1 and (2-1)/1 relate the data taken from Sensor 1 and Sensor 2 and are only available on a two-sensor system.

The remaining options vary depending on the selections you have made for Group A, Group B and Collect Group B on setup page SET1-1 or SET1-2. For example, if you have assigned Group A to consist of 5 samples and are not collecting data from Group B, the remaining options will be SAMPLE 1, SAMPLE 2, SAMPLE 3, SAMPLE 4 and SAMPLE 5.

These options (SAMPLE 1, etc.) work in conjunction with the next option, Sample, and allow you to exclude any number of samples from the computed averaged data. To exclude, for example, samples 1 and 3:

1. Place the cursor on the POST pro comp: field and press the SELECT NEXT OPTION key until SAMPLE 1 is displayed.
2. Use the down-arrow key to move the cursor to the Sample field and press the SELECT NEXT OPTION key to display EXCLUDE.
3. Use the up-arrow key to move the cursor to the Post pro comp field and press the SELECT NEXT OPTION key until SAMPLE 3 is displayed.
4. Use the down-arrow key to move the cursor to the Sample field and press the SELECT NEXT OPTION key to display EXCLUDE.

After you have finished this procedure, place the cursor on the Post pro comp line again and cycle through the options by pressing SELECT NEXT OPTION. The Sample field should accurately reflect which samples are to be included and excluded from the averaged data. Upon exiting the setup screen, the requested computations are displayed. This facility is only available when a single set of samples is completed.

% Sampled

The % Sampled field specifies what percent of the entire volume is sampled.

NOTE

Enter this data only when the Micro LPS is in SPECTROMETER mode. If the instrument is in MONITOR mode, change modes, then enter the sample volume.

If you are using a volumetric sensor, the entire sample flows within the sample area; specify 100 (%).

If you are sampling in-situ, only a portion of the entire volume flows through the sample area. In this case, the percent to be entered in this field varies depending upon the sample area for the particular sensor installed in your system and (in the case of an LVMS) the size viewing module in use.

Please refer to the specifications portion of the sensor manual to determine the percent of total volume sampled. The sensor manual gives the percent sampled in spectrometer mode.

Vertical Scale

This option indicates what the total percentage displayed on the vertical scale will be when you view the histogram data display.

Use the alphanumeric keypad and right- and left-arrow keys to indicate the maximum percent viewed. The minimum allowable value is 5%; the maximum allowable is 100%. Refer to Histogram Data Displays in Chapter 7 for more information.

View Module

This option keeps track of the data recorded for each view module when used with an LVMS. View modules may be designated A through Z. Before data is collected, be sure to select the appropriate letter using the SELECT NEXT OPTION key for the view module currently being sampled. This option works in conjunction with the next option. The only letters selectable for this option are those defined by the next option (Max View Module).

Max View Module

Use this option to indicate how many view modules are in your system. For example, if you have five modules, they are designated A through E. Enter the letter E in this field.



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Min Flow	<p>If you are running samples in the flowmeter mode and want to specify a minimum acceptable flow rate, use this field to enter that flow rate in milliliters per minute. The Micro LPS monitors the flow rate and when the flow rate falls below the minimum level, the Micro LPS stops taking sample data. The instrument will still display the RUNNING flag and will resume data-taking when the flow rate reaches the minimum level. If the flow exceeds 10 times the Min Flow, the Micro LPS also stops taking data and waits for the flow to come within the acceptable range. The sample interval in the flowmeter mode is determined by the sample volume, therefore, the sample interval may be extended. This option is not applicable if you are using a sampler.</p>
Units	<p>Select either liters or milliliters to indicate the Sample Volume (refer to setup page SET1-1 and SET1-2) unit of measure.</p>
First Sample	<p>Use this option to determine whether the results of the first sample will be used or discarded. If the first sample results are to be retained, select Accept using the SELECT NEXT OPTION key. If the first sample results are to be discarded, select Reject.</p>
Sampler Type	<p>Use this option to specify the type of sampler attached to the Micro LPS. Use the SELECT NEXT OPTION key to display the following samplers in this order:</p> <ul style="list-style-type: none"> LBS-100 CLS-500 CLS-300 CLS-600 SOPS-100 CLS-200 CLS-100 <p>Notice that the options appearing directly below Sampler Type vary depending on which sampler is currently displayed.</p>

LBS-100

If you select LBS-100 for the Sampler Type, no other options appear. The LBS-100 is controlled from the front panel of the LBS-100. If you are using an LBS-100, refer to the LBS-100 manual for operating information.

CLS-500

If you select CLS-500, the following options appear:

```

SET2-1 90/09/10 16:11:31
ID:MLPS      A : 1 → 6
SI:00:00:20  TR:00:00:00

Post pro comp: A
Sample: INCLUDED

% Sampled: 100.0000
Vertical Scale: 50.00
View Module: A
Max View Module: A
Min Flw(ml/min):0.00
Units: milliliters
First Sample: accept
Sampler Type: CLS-500
Mode: BURET
Buret Volume: 100.0
Control from: MLPS-16
  
```

SELECT
NEXT
OPTION

PREV
SCREEN

NEXT
SCREEN

Mode

Select either BURET or FLOW CONTROL. If you select BURET the sample volume is measured by drawing the aliquot into the CLS-500 buret. If you select FLOW CONTROL the sample flow rate is controlled by the CLS-500 flow controller to determine the sample volume.

BURET Mode

The following options appear if you select BURET mode.

Buret Volume

Use the SELECT NEXT OPTION key to display the sample volume: either 10, 25, 50 or 100 milliliters.



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Control From	Specify the instrument from which sampling will be started and stopped by selecting either SAMPLER or MICRO LPS. If the sampler is in control, only BURET mode and SINGLE sample modes are allowed. Continuous sampling is disallowed.
FLOW CONTROL Mode	<p>If you select FLOW CONTROL mode, the Micro LPS determines the sample interval required by the CLS-500 by dividing the sample volume by the flow rate. The flow rate is computed every time a BURET sample is run. Therefore, you must run a buret-mode sample to calibrate the flow controller. If a different flow rate is required, you must recalibrate the controller by running buret-controlled samples until the desired flowrate is achieved. The recomputed flow rate is displayed in the Flow Rate field on SETUP1-1.</p> <p>The following options appear if you select FLOW CONTROL.</p>
Flow Volume	Use the alphanumeric keys to enter the volume of liquid to be drawn from the sample bottle. The number must agree with the Units field specified earlier (liters or milliliters).
Sample Volume	<p>Use the alphanumeric keys to enter the sample volume. Any volume may be designated. Use the following formula to arrive at the sample volume:</p> $\text{Sample Volume} = \text{Flow Volume} \times \% \text{ Sampled}$
NOTE	Enter this field only when the Micro LPS is in SPECTROMETER mode. If the instrument is in MONITOR mode, change modes, then enter the sample volume.
CLS-300	<p>If you select CLS-300, the following options appear:</p>

Setup Screens

```
SET2-1 90/09/10 16:11:31
ID:MLPS A:1 → 6
SI:00:00:20 TR:00:00:00
```

```
Post pro comp: A
Sample: INCLUDED
```

```
% Sampled: 100.0000
Vertical Scale: 50.00
View Module: A
Max View Module: A
Min Flw(ml/min):0.00
Units: milliliters
First Sample: accept
Sampler Type: CLS-300
Compression Dly: 00
Buret Volume: 100.0
```

```
SELECT
NEXT
OPTION
```

```
PREV
SCREEN
```

```
NEXT
SCREEN
```

**Compression
Delay**

The Compression Delay is the amount of time allotted for the liquid contained in buret 1 to be pressurized before it is allowed to flow through the sensor. This pressurization removes bubbles from the liquid. The time required varies depending upon the liquid being sampled, the viscosity, the amount of turbulence and air bubbles in the sample, and the sample pressure. The time must be individually determined for each system. Enter the Compression Delay time in seconds. A delay of up to 99 seconds is allowed.

Buret Volume

Using the SELECT NEXT OPTION key, choose from the available preset volumes: 25, 50, 75 or 100 milliliters.



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CLS-600

If you select CLS-600 the following options appear:

```

SET2-1 91/01/08 17:36:53
ID:      A : 1 → 6
SI:00:00:20 TR:00:00:00
Post pro comp: A
Sample: INCLUDED

% Sampled: 100.0000
Vertical Scale: 50.00
View Module: A
Max View Module: A
Min Flw(ml/min):0.00
Units: milliliters
First Sample: accept
Sampler Type: CLS-600
Compression Dly: 00
Buret Volume: 45.0
  
```

SELECT
NEXT
OPTION

PREV
SCREEN

NEXT
SCREEN

Compression Delay

The Compression Delay is the amount of time allotted for the liquid contained in the buret to be pressurized before it is passed through the sensor. The pressurization removes bubbles from the liquid. The time required varies depending upon the liquid being sampled, the viscosity, the amount of turbulence and air bubbles in the sample, and the sample pressure. The time must be individually determined for each system. Enter the Compression Delay time in seconds. A delay of up to 99 seconds is allowed.

Buret Volume

The sample volume for the CLS-600 is 45 ml and is automatically set by the Micro LPS.

SOPS-100

If you select SOPS-100, the following options appear:

```

SET2-1 90/09/10 16:11:31
ID:MLPS A: 1 → 6
SI:00:00:20 TR:00:00:00

Post pro comp: A
Sample: INCLUDED

% Sampled: 100.0000
Vertical Scale: 50.00
View Module: A
Max View Module: A
Min Flw(ml/min):0.00
Units: milliliters
First Sample: accept
Sampler Type: SOPS-100
Syringe Volume: 1.00 ml
Fill Speed: 2.0 ml/min
Drain Speed: 2.0 ml/min
    
```

SELECT
NEXT
OPTION

PREV
SCREEN

NEXT
SCREEN

Syringe Volume

Use the SELECT NEXT OPTION KEY to select the size of the syringe installed on the SOPS-100.

Fill Speed

Use the alphanumeric keys to specify the syringe fill speed in milliliters per minute.

Drain Speed

Use the alphanumeric keys to specify the syringe drain speed in milliliters per minute.



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CLS-200

If you selected CLS-200, the following options appear:

```

SET2-1 90/09/10 16:11:31
ID:MLPS A: 1 → 6
SI:00:00:20 TR:00:00:00

Post pro comp: A
Sample: INCLUDED

% Sampled: 100.0000
Vertical Scale: 50.00
View Module: A
Max View Module: A
Min Flw(ml/min):0.00
Units: milliliters
First Sample: accept
Sampler Type: CLS-200
Fill Speed: 0
Drain Speed: 0
Count during: fill
Control from: MLPS-16
  
```

SELECT
NEXT
OPTION

PREV
SCREEN

NEXT
SCREEN

These options are described in the following paragraphs. Please refer to the CLS-200 manual for additional information.

Fill Speed

Fill speed is not set in terms of volume per unit time, but as a number (from 0 to 63) which is proportional to the speed of the syringe piston movement which creates the vacuum necessary to move the fluid. The values 0 to 60 span the range from zero to one-quarter full speed. Values 61, 62 and 63 select one-half, three quarters and full speed, respectively. Use the alphanumeric keypad to enter the number.

Drain Speed

Options for this field are the same as those for Fill Speed.

Count During

You may elect to count particles either while the buret is being filled or drained. Use the SELECT NEXT OPTION key to select either fill or drain.

Control From

Use the SELECT NEXT OPTION key to indicate whether the sampling operations are to be controlled from the Micro LPS or the CLS-200. In order to select CLS-200, you must have selected SAMPLER mode on setup page SET1-1.

CLS-100

If you selected CLS-100, no options appear. The CLS-100 is no longer manufactured by PMS and is no longer supported by the Micro LPS data system.

SET3-1 and SET3-2 Options

The third setup page allows you to configure the analog options and enable alarms. Use the NEXT SCREEN key to display this screen. The screen appears as follows:

```
SET3-1 90/09/10 16:11:31
ID:MLPS A: 1 → 6
SI:00:00:20 TR:00:00:00
```

```
Analog data display
Device: Analog 1
Label: Analog 1
Base value: 0.0
Full scale value: 5.0
Units: Volts
Active?: YES
```

```
Max DC lvl, Pb 1=0.00
Max DC lvl, Pb 2=0.00
```

```
Alarm Enable: NO
Alarm Print: NO
Alarm Size: 0.20
Alarm Value: 1000
```

```
SELECT
NEXT
OPTION
```

```
PREV
SCREEN
```

```
NEXT
SCREEN
```

```
-
```



Chapter 6

	<p>The Micro LPS can handle up to four analog inputs from sensors with outputs from 0 to 5 volts. These sensors may be temperature and humidity probes purchased from PMS, or other types of sensors, as long as they adhere to the 0- to 5-volt requirement. The analog input port is located on the back of the instrument and is labeled ANALOG INPUT. In order for the Micro LPS to properly interpret the information being sent from these various analog devices, monitor for alarm conditions and print reports, analog setup information must be entered via the next six options.</p>
Device	<p>This field identifies the analog device for which the next five currently displayed parameters are being configured. Use the SELECT NEXT OPTION key to display either Analog 1, Analog 2, Analog 3 or Analog 4.</p>
Label	<p>Enter an ID for the analog device identified on the previous line using any combination of characters and spaces available on the alphanumeric keypad. Refer to the guidelines for using the alphanumeric keys described under Setup Page 1 Options.</p>
Base Value	<p>This entry tells the Micro LPS what 0 volts of input equals in analog device units. Enter the 0-volt value for this analog device using the alphanumeric keypad.</p>
Full Scale Value	<p>This entry tells the Micro LPS what 5 volts of input equals in analog device units. Enter the 5-volt value for this analog device using the alphanumeric keypad.</p>
Units	<p>Use this six-character field to enter an alphanumeric label for the units being reported. You may, for example, enter "PCT" for percent (humidity). The units will be identified on the analog data display and on printed reports.</p>
Active?	<p>The attached analog devices are continuously sending signals to the Micro LPS; however, data are not monitored by the instrument unless YES is selected in this field. To change from NO to YES and vice versa, use the SELECT NEXT OPTION key.</p>

Max DC lvl, Pb 1 =	<p>Use this field to set an upper alarm threshold to monitor the background light level on the sensor's detectors and ensure the accuracy of reported data. Normally, well below 1 volt is developed by background light; however, if the instrument becomes dirty the voltage level will increase.</p> <p>A good way to determine a reasonable threshold is to clean the sensor capillaries and then look at the Analog data page (refer to Chapter 7). At the bottom of the page the DC levels for probes 1 and 2 are reported. Set the alarm threshold at some higher value using the alphanumeric keypad to enter the highest acceptable DC voltage for probe 1. If the DC voltage from background light exceeds this level, an alarm message appears.</p> <p>Enter 0.0 to disable the function.</p>
Max DC lvl, Pb 2 =	<p>This option is the same as the previous option, except that the background light level is monitored for probe 2.</p>
Alarm Enable	<p>Use this option to enable or disable the alarm by selecting either YES or NO. When an alarm threshold is exceeded, an audible tone sounds and an alarm flag appears on the display. If you select YES, use the following fields to specify the particle size and value.</p>
Alarm Print	<p>If you want a printed report to be generated whenever an alarm threshold is reached, use the SELECT NEXT OPTION key to display YES. If you do not want a printed report, select NO.</p>
Alarm Size	<p>Use the SELECT NEXT OPTION key to cycle through the size classes. Display the size class you wish to have monitored for the alarm condition.</p>
Alarm Value	<p>Use the alphanumeric keypad to enter the number of counts that constitute an alarm condition. Accumulative counts are monitored. In other words, if you select 5000 counts in the 3.0 micron size class, when 5000 particles are detected 3.0 microns or larger, an alarm message is displayed.</p>





Data Displays

In the previous chapter the setup screens were addressed. Their purpose is to configure the Micro LPS for sampling and reporting. The data screens, on the other hand, monitor data-taking during sampling and report real-time data.

To access a data display from a setup display, press the SETUP key. There are three types of Micro LPS data displays:

- Tabular
- Histogram
- Analog

You can access each of these data displays by pressing the up- or down-arrow key.

This chapter describes:

- the fields appearing in data screen headers which are pertinent to data screens
- the data display soft keys
- each of the three data display formats

The Data Display Header

The information contained in the first three lines of the data display header are identical to those in the setup displays except that in a data display instead of saying SETUP, the identifier in the upper left corner tells what type of sensor is connected to the Micro LPS; for example, HSLIS, IMOLV, etc. The date, time, ID, and sample interval (SI) fields are all specified by the user in the setup screens. The remaining header items are significant in the data screen and are described in the following paragraphs.

FR (Flowrate)

This field appears only if you are using a CLS-600 and only for a few seconds after sampling is complete. It reflects the average flowrate over the sample interval.

*Chapter 7***A/B (Group and Sample Number)**

This field identifies the sample currently being taken or the sample(s) to which the currently displayed data applies. The sample is identified by group and sample number; for example, if the screen displays:

A : 1

either the first sample of group A is currently being taken or sample 1 of group A is completed and the data is shown.

When a group sampling is completed, this field shows the total number of samples in the group. For example, when a group of 10 samples has been completed in group A, the screen shows:

A : 1 → 10

If any of the samples from this group has been excluded from the averaged data, an "e" appears after the group letter indicating that one or more samples have been excluded from the final calculation of sampled data:

Ae : 1 → 10

TR (Time Remaining)

Time remaining is updated each second and indicates how much time is left in the sample interval or the delay, whichever is applicable. If the sampler is in control of this interval, the message SAMPLER WAIT appears in this field.

Data Display Soft Keys

As described in Chapter 4, each soft key is labeled on the display and directly to the left of the key. The data screens have four soft keys:

STOPPED / RUNNING / DELAYED / FINAL
 SENSOR ONE / SENSOR TWO
 ACCUM / DIFF
 COUNTS / N/ml

**STOPPED/
RUNNING/
DELAYED/
FINAL**

Use the top-most soft key to begin and stop sampling.

STOPPED indicates that the operator has manually stopped the sampling process by pressing this key. The TR field shows the time remaining in the sample interval.

**SENSOR ONE/
SENSOR TWO**

RUNNING indicates that the operator has begun data-taking by pressing this key and data-taking is currently in progress. The time remaining (TR) counts down the time left in the sample interval (SI). The current sample number is shown in the A/B field.

DELAYED indicates that the Micro LPS is in the delay time between individual samples within a group and is counting down the delay interval (also reflected in TR) before beginning the next sample.

FINAL indicates that the Micro LPS has completed a single sample or a group of samples.

If the currently-displayed sensor is the slave sensor, this soft key is inoperative. Sampling must be started and stopped from the independent sensor's display.

This key toggles between sensors one and two. Any changes to operations (starting or stopping sampling) will only affect the sensor currently identified by the label (either sensor one or two) if the sensors are collecting data in INDEPENDENT mode. For example, if the label reads **SENSOR TWO**, and you press the top-most soft key (labeled **STOPPED**), the Micro LPS begins data-taking operations from sensor two. If, however, one of the sensors has been designated to operate in **SLAVE** mode, when you begin one sensor sampling, data are collected from both.

This key is also used when configuring the system using the setup screens. When a setup display is accessed from a data display that shows **SENSOR ONE**, the setup parameters are those that apply to sensor one; when a setup display is accessed from a data display that shows **SENSOR TWO**, the setup parameters are those that apply to sensor two.

ACCUM/DIFF

Press this key to display the data in either accumulative or differential mode. If this key does not appear on your data displays it is because the display already shows the data in both forms.



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```

HSLIS 90/09/11 11:35:24
ID:FAB 10 A:1
SI:00:02:00 TR:00:00:04
SIZE DIFF ACCUM
µ N N
0.10 131 5462
0.12 487 5331
0.14 2217 4844
0.16 2591 2627
0.18 11 36
0.20 7 25
0.22 4 18
0.24 4 14
0.26 4 10
0.28 1 6
0.30 2 5
0.40 1 3
0.50 0 2
0.60 1 2
0.80 1 1

```

RUNNING

SENSOR ONE

COUNTS

LREF 8.4

S

DIFF indicates that differential counts are being displayed and each particle is being counted in its size class only.

ACCUM indicates that accumulative counts are being displayed and the data appearing in each size class represents all particles detected of that size class and larger.

COUNTS / N/ml

Displayed data may be in the form of actual raw counts or normalized counts per milliliter. Use this key to toggle from one data format to the other.

Data Displays

The Micro LPS displays sample data in two formats: tabular and histogram. A third display reports data received from peripherals: the analog display.

To access the tabular data display from a setup screen, press the **SETUP** key. To view the other two data displays (histogram and analog) press the up- or down-arrow key. To return to the setup screen, press **SETUP**. All data displays are shown in real-time; that is, data is displayed at essentially the same time the particle is detected or the analog data is received.

Tabular Data Displays

A typical tabular display appears in the following format:

IMOLU 90/10/04 08:10:37			FINAL REPORT
ID: A:1			
SI:00:03:00 TR:00:00:19			
SIZE	DIFF	ACCUM	
μ	N	N	
0.30	3.36e+5	1.67e+7	SENSOR ONE
0.40	2.36e+5	1.64e+7	
0.50	3.71e+5	1.61e+7	
0.60	2.44e+5	1.58e+7	
0.80	2.17e+5	1.55e+7	
1.00	3.28e+5	1.53e+7	
1.50	1.90e+5	1.50e+7	
2.00	3.28e+5	1.48e+7	
3.00	1.93e+5	1.45e+7	
4.00	2.69e+5	1.43e+7	
5.00	3.02e+5	1.40e+7	COUNTS
6.00	3.60e+5	1.37e+7	
8.00	1.82e+5	1.33e+7	
10.00	1.24e+7	1.32e+7	
12.00	593083	737935	
15.00	144852	144852	LREF 10.0

Size classes are shown at the left. A size class is defined by a range of particle sizes, for example: 0.30 to 0.40 microns, 0.40 to 0.50 microns, and so on. The size classes reported by your system depend upon which sensor you have. If your screen shows two columns of data, the first represents differential counts; the column to the right shows accumulative counts. When accumulative counts reach 10,000,000, the counts in both columns are displayed in scientific notation. For example, the number 16,742,810 is expressed as 1.0×10^7 and is displayed as 1.67e+7.

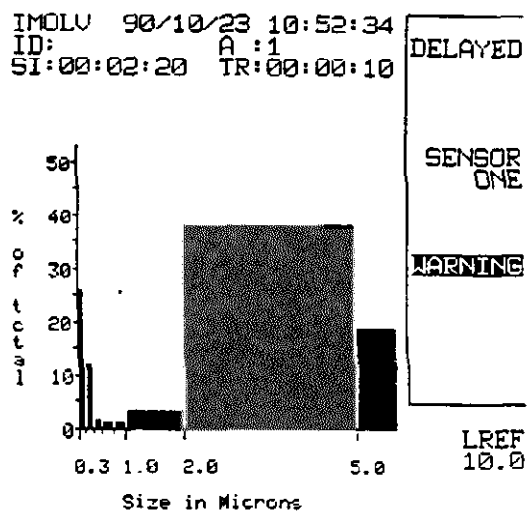
Histogram Data Displays

The histogram data displays show data in a graphic format. The size classes are displayed on the horizontal axis. The Micro LPS histogram shows what percentage of the total counts presently taken fall into each size class. You can toggle from a differential to an accumulative histogram display by pressing the ACCUM/DIFF key.

You can alter the total percent displayed on the vertical scale using the Vertical Scale option available on the second page of the setup screens. This allows you to scale the histograms to see small changes more clearly or view peaks that might otherwise be off the display. Refer to Chapter 6.



Chapter 7



Analog Data Display

The analog data display monitors the analog input status from each of up to four sensors which may be connected to the Micro LPS. In order for the Micro LPS to display analog data, each device must be enabled using the "Active ?" option on setup page 3. The label assigned to each analog device and units assigned on setup page 3 appear on the analog display as follows:

Data Displays

HSLIS 90/09/11 11:47:32			DELAYED
ID:FAB 10 A: 1 → 1			
SI:00:02:00 TR:00:00:06			
Device	Value	Units	
Analog 1	5.000	Volts	SENSOR ONE
Analog 2	5.000	Volts	
Analog 3	5.000	Volts	
Analog 4	5.000	Volts	
DC LV 2	10.00	VOLTS	NORMAL
LR REF2	10.00	VOLTS	
DC LV 1	10.00	VOLTS	
LR REF1	0.995	VOLTS	

M

The lower portion of the analog display reflects the current DC light levels and reference voltages for probes one and two.

When NORMAL is selected using the bottom soft key, the Micro LPS cycles through and updates one of the (up to) eight readings every 0.2 seconds. If you want to monitor one of the laser reference voltages or DC light levels more closely, press the NORMAL soft key to display one of the following:

FST LR1
FST LR2
FST DC1
FST DC2

The selected sensor data will then be updated every 0.2 seconds on the display.





Maintenance

The filter membrane in the absolute 0.04 filter is capable of producing water adequate for testing from any source for a short term. If water is not frequently changed or the system is allowed to remain stagnant, the LPFS-200 will be difficult to clean up and need frequent filter changes. For optimum operating and maintenance conditions, keep a constant supply of DI water (approximately 2 ml/min) continuously feeding the system and then draining through the overflow drain. This setup reduces the opportunity for organic contamination to develop in the filter membranes.

In addition, approximately once a week, add 2 to 3 ml of liquid chlorine bleach to the system. Then slowly dilute the bleach out with DI water or, after an hour of run time, change the water.

WARNING

Do not sanitize constantly or at high concentrations. Prolonged or concentrated exposure to chlorine will damage the 0.04 micron filter.

Most filter failures occur from system stagnation, travel, allowing the system to run dry, or failure to change water. If the water will not clean up to acceptable levels, or if the flow rate cannot be brought up to the desired level, change the filter. When changing the filter, do not contaminate the outside of the replacement filter by touching it to contaminated surfaces. The replacement filter number is SU070.

Disassembling the LPFS-200

It may become necessary to disassemble the LPFS-200 if debris is drawn into the pump inlet. Evidence of this condition is most commonly noisy pump operation or failure of the motor to turn.

1. Dump the water out of the system by turning it upside down over a drain.
2. Remove the 1/4-20 socket head screw from the reservoir support plate (refer to Figure 5-1).

Chapter 5

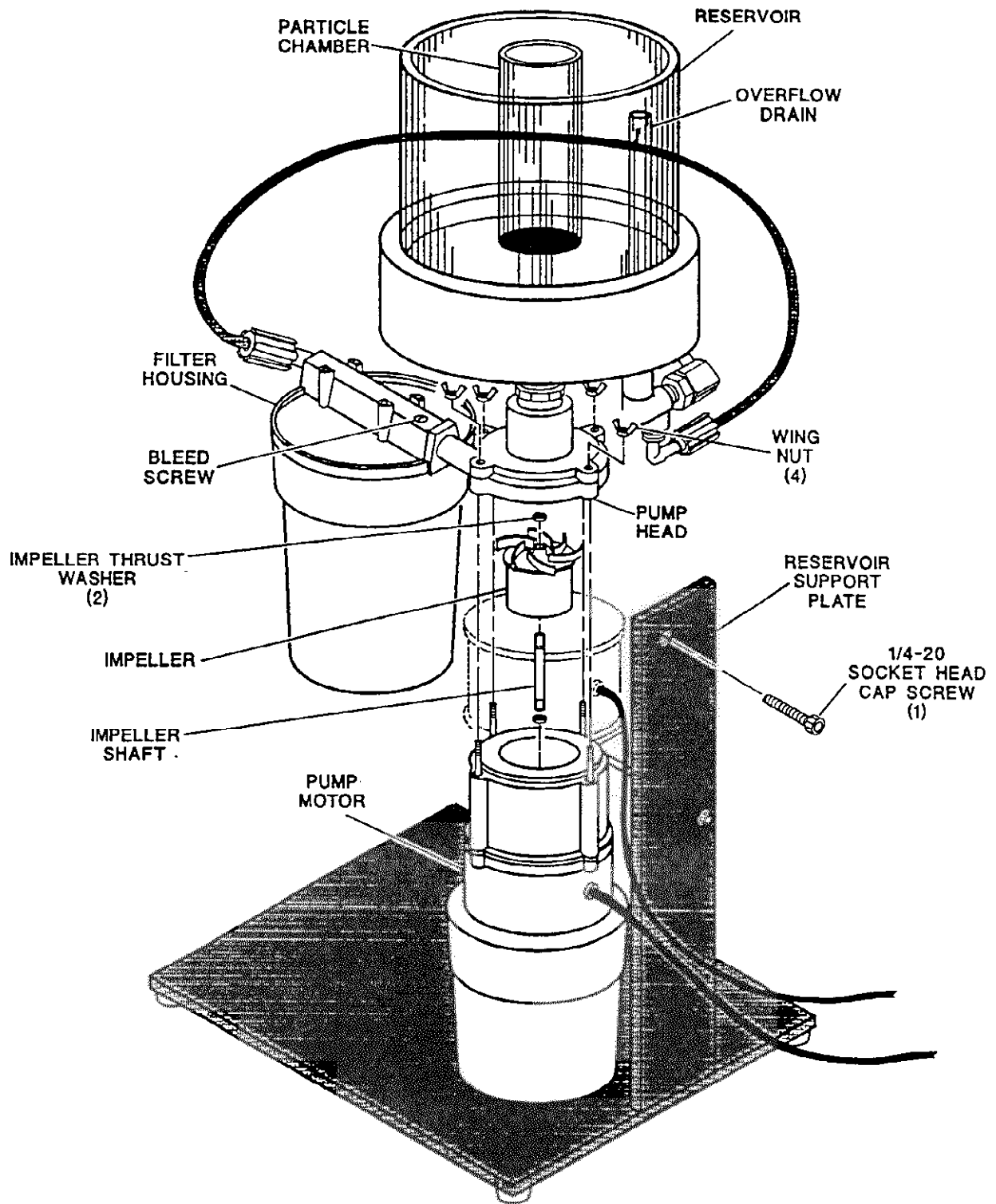


Figure 5-1. LPFS-200 Assembly

3. Remove the four wing nuts from the pump head.
4. Lift the reservoir, filter housing, pump head and plumbing assembly off the pump motor.
5. Remove the impeller thrust washers, impeller and impeller shaft from the pump.
6. Check for debris in the pump and clean as required.

Reassembling the LPFS-200

1. Place the impeller shaft, thrust washers and impeller on the pump (Figure 5-1).
2. Place the stirrer on its stand.
3. Install the reservoir and filter assembly by placing the pump head over the pump. Secure the pump head using the four wing nuts (Figure 5-1). Tighten the wing nuts evenly.
4. Secure the reservoir to the side plate using the 1/4-20 socket head cap screw.



HSLIS Maintenance

The only routine maintenance required is cleaning of the optical elements and occasional optical alignment.

Optics Cleaning

There are a total of eight optical surfaces which may require cleaning; the other elements are sealed and not exposed to any contamination. These surfaces are the two surfaces of each cylinder lense comprising the condensing optics and the window surfaces exposed to liquid. The cylinder lens surfaces can be cleaned with acetone and Q-Tips. The lens surfaces rarely need to be cleaned in the field, however, the wetted window surfaces can be contaminated by dirty fluids or develop drying stains if allowed to dry out. The windows can be cleaned by first removing an inlet fitting located on either the top or bottom of the sample block and lightly scrubbing the inside of the sample cell with a miniature Q-Tip dipped in acetone or ultra-pure DI water.¹

NOTE

It is necessary to shut off the flow and drain the sample tube before attempting to remove the inlet or outlet fitting.

¹ Recommend Berkshire Swab #LT670183 (samples are provided with each instrument).

Chapter 6

One can determine if optics cleaning is necessary by monitoring the peak-to-peak noise level of the test signal output (outputs on the rear of the data acquisition system). If the peak-to-peak noise level is sufficient to trigger the first threshold of the high gain, optics cleaning is necessary. Another indication is if low counts occur in Size Channels 1 and 2 where a log normal distribution is expected. This condition suggests that excessive rejection is occurring in the low channels, the result of a high noise condition.

NOTE

In the monitor mode excessive counts will occur in channels 1 and 2 for all high noise conditions.

Optical Alignment

In order to have correct particle sizing, the laser beam must be aligned within the collecting optics viewing volume. Alignment can be accomplished by sampling monodispersed latex particles and adjusting the x-y adjustment screws (located on the condensing lense mounts). One can then maximize the counts observed on the CRT on the highest possible channel. Adjustment should be made in both the vertical as well as the horizontal directions; the vertical axis is more sensitive because the laser beam is highly astigmatic. Since latex polystyrene spheres may be chemically incompatible with certain liquids, it is suggested that the test samples use water. If coagulation or size distortion results, alignment must be accomplished with a liquid which is chemically compatible with the latex polystyrene spheres and is of a similar refractive index to water. Water is generally preferred.